DIMORPHISM IN BLISSUS LEUCOPTERUS.

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Two forms of the chinch bug are recognized by entomologists — the one having wings fully developed, the other having wings more or less abortive. Between the two extremes of fully winged and almost wingless all gradations exist. Where the short-winged form occurs it is usually intermixed with long-winged individuals. Such a mixture appears at certain times in abundance in the timothy meadows of northeastern Ohio. It was from Trumbull, Portage, Mahoning and Stark counties of this state that Professor F. M. Webster furnished the principal portion of the material for the present study.

The study was undertaken with the direction of Professor C. B. Davenport to determine by quantitative methods the biological significance of the dimorphism.

METHOD.

The insects examined represented several random collections from different points. For study they were taken from the various bottles with no attempt at selection so those studied are presumed to present fairly the conditions in the whole group.

Where practicable, the wings were carefully removed from the body and mounted in a series on glass slides. By means of a dissecting microscope of low power and a camera lucida the image of the wing was projected upon a magnified scale and the length thus read to tenths of a millimeter. With museum material it was necessary to measure the wings in situ and this was accomplished by the use of a metal scale divided to fifths of a millimeter placed against the wing under a lens.

THE FREQUENCY POLYGONS.

The size of a class was fixed at one fifth of a millimeter and this gave a range of ten classes. The polygon is bimodal, one mode being at 1.5 mm. and the other at 2.7 mm. The extremes of the range include from 1 mm. to 2.99 mm.

For convenience in calculation the polygon was considered as two, the first having six and the other five classes, the small connecting class being divided between the two polygons. Both polygons are skew, running down very rapidly on their outer slopes and shading off gradually toward each other to be connected by a very small class. The skewness of the polygon with the mode at 1.5 mm. is + .0235 and that of the one with the mode at 2.7 mm. is — .018.

An examination of short-winged specimens from California and from Long Island kindly loaned from the National Museum by Dr. L. O. Howard and others from New York State loaned by Dr. C. E. Felt gave polygons with the same mode as that obtained from short-winged material from Ohio. Similar results were obtained by a comparative study of long-winged insects sent from Urbana, Ill., by Professor S. A. Forbes. This indicates that the tendency of a given form is toward the same mode from whatever region taken or whether the two forms are mixed or separate.

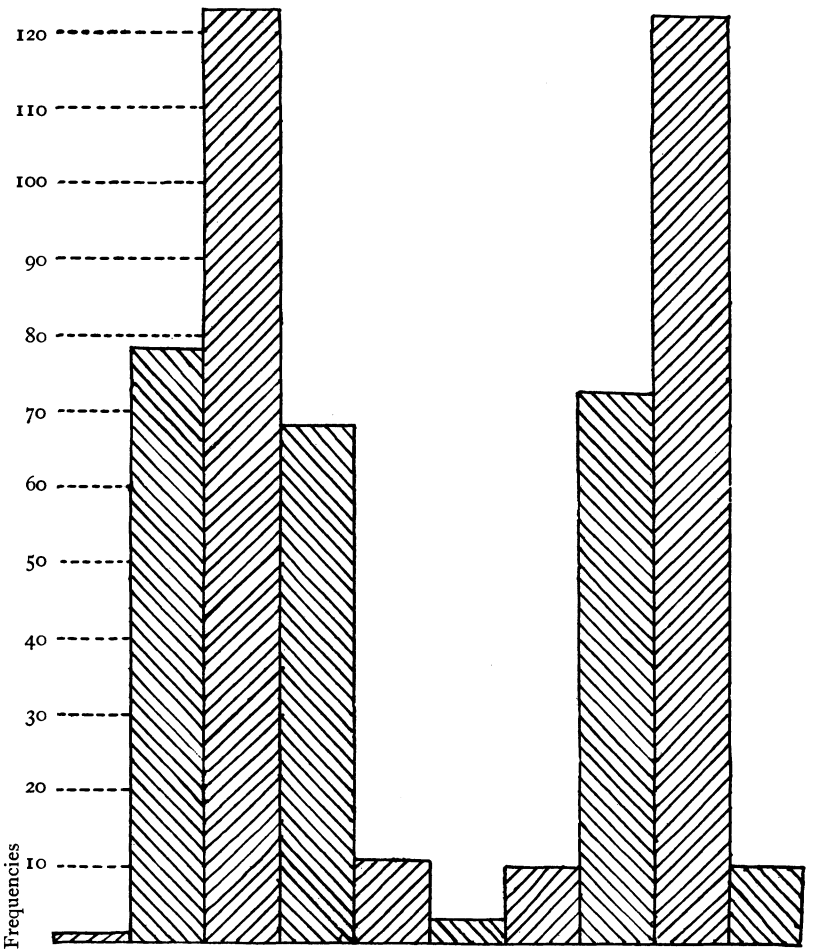
Discussion of Results.

The significance of these results is by no means easy to determine. Looking at the polygons only it seems reasonable to suppose that the present dimorphic species has been derived from a parent stock with a mode lying somewhere between the two present ones. In that case it may be assumed that differences of environment have permanently impressed themselves, dividing the parent stock into two evolutionary lines one of which at present has wings longer and the other wings shorter than the parent stock.

The evidences of geographic distribution appear to negative this view. The genus is almost cosmopolitan, having been reported from every continent save Asia and from many islands of the sea. So far as known, it is most abundant and certainly most destructive in the United States. Nevertheless there are good reasons for regarding the chinch bug not as a native but as an immigrant. In his very reasonable hypothesis about the origin and distribution of the chinch bug in North America, Professor Webster (1898)[1] assumes that our stock of chinch bugs has come

[1] Webster, F. M., "The Chinch Bug," U. S. Dept. of Agriculture, Bulletin No. 15, New Series.

from South America by way of the Isthmus of Panama, Central America and Mexico. The north-flowing stream was divided first by the Cordilleran system, one branch of the division following the Pacific Coast northward, the other, by far the more im-

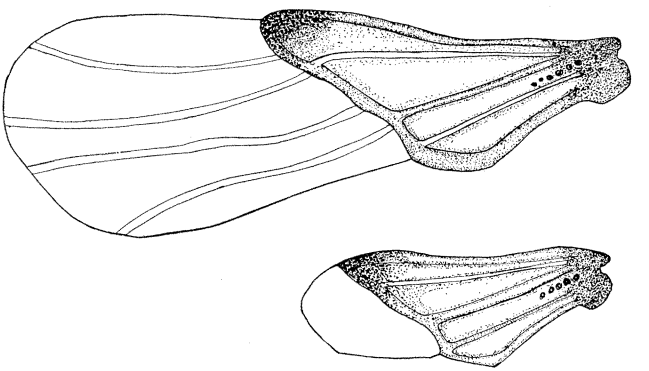


portant one, spreading over the Gulf States, was split again by the Appalachian Mountain System. One of these latter branches overflowed the Mississippi Valley; the other, following the coast of the Atlantic, finally rounded the north end of the mountain system and finding a congenial highway across New York State

joined the Mississippi Valley branch in northern Ohio and around the Great Lakes.

The short-winged form, so far as known in America, is confined to the ocean coasts and the immediate vicinity of the Great Lakes. The vast interior region from Central America to Manitoba abounds with only the long-winged form.

If Webster's theory is the correct one, we can scarcely escape the conclusion that the short-winged form originated in the regions where it is at present found. No short-winged specimens have ever been reported from the Gulf States outside of Florida, from Mexico or Central America, nor west of the Alleghanies,



notwithstanding, the insect is common in those regions and the short-winged form has been carefully looked for in some of them. The long-winged insects, then, appear to have been the ancestral form in America as far as history and hypothesis can give a clue. There seems to be an inherent tendency in the species to produce the short-winged form when the proper ecological conditions are provided. How the species acquired this tendency is a very difficult thing to understand and it is not the purpose of this paper to attempt an explanation of a phenomenon that appears to be older than the division of Heteroptera into the present recognized families.

According to Saunders[1] dimorphism is exceedingly common among British Heteroptera and this caused much confusion

[1] Saunders, Edward, F.L.S., "The Hemiptera — Heteroptera of the British Islands," 1892.

because long- and short-winged forms were placed in separate species, certain other correlated characters, *e. g.*, a weaker developed pronotum in the short-winged form being constant.

In the Family Lygeidae all grades of winged shortening occur and in some species a fully-winged individual is very rare. Indeed every important family shows wings shortening to some extent.

Though the short-winged form occurs in America almost exclusively near large bodies of water such proximity is not necessarily a factor in producing and preserving this peculiar character.

A closely related species, *B. doriæ*, is comparatively abundant in southern Europe and far northward into the interior of Hungary. A long-winged specimen of this species is a rarity and was not supposed to exist until 1880 when a very small colony was discovered by Professor Sajö. From his paper, presented in full in Professor Webster's bulletin previously cited, we get the facts concerning this species.

The colonies of *B. doriæ* live on the bases of bushy grass near or even under the surface of the ground, and here the stages of development are passed through. The species is very widely distributed on sand drifts and in hilly regions, but long-winged specimens were found in but a single tiny spot. The bunches of grass on which the insect lives are isolated in partially bare ground. During the period of development, *great drought prevails.* The long-winged specimens possess a stronger and broader thorax than the short-winged ones, and it never attacks cultivated crops.

According to numerous observers cited by Professor Webster, the habits of *B. leucopterus* along our coasts are almost identical with those described for *B. doriæ.* Professor C. W. Woodworth writes me that the chinch bug is found in California chiefly in the salt marshes.

Summary.

Where short-winged chinch bugs occur in Europe and America their habitat almost without exception compels them to live about the roots of tufts of grass on a soil otherwise almost bare. In California they are found in salt marshes. In Europe it may

be added that the developmental stages occur at a season of great drought. Taken all together we have a picture *par excellence* of a xerophilous insect which is only another way of designating a species capable of withstanding hard or unfavorable conditions of living. Among the hard conditions which are responsible for dwarfed wings as well as more or less dwarfed bodies of chinch bugs, I should place first drought and poor food supply. Latitude and climate do not influence them, but edaphic conditions that may extend over large areas are the potent factors.

The only recorded observation that seems to oppose this view is that of Mr. E. P. Van Duzee.[1] He states that in portions of Ontario and New York where the short-winged form usually predominates, in dry, hot summers they mostly acquire fully developed wings. It seems possible, however, that a dry hot summer added to an ordinarily unfavorable habitat may have destroyed the short-winged form to an extent, only those in the most favored places being allowed to develop.

That the short-winged form should extend at times beyond the borders of the particular habitat which served to develop the dimorphic tendency (as occurs for example in northern Ohio) may be regarded only as the persistence for a time of a character acquired by the race even when the insect is in different surroundings. The mixed forms, however, always cling to old food habits as far as possible, taking by preference to grass meadows instead of attacking grain fields as do the long-winged insects of the interior.

[1] Van Duzee, E. P., *Canadian Entomologist*, Vol. XVII., pp. 209–210, 1886.

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